Arabic and the Art of Printing

by: Saudi Aramco World Magazine

In this special section reproduced from Aramco World (issue March/April 1981), distinguished authors cover topics related to printing in the Islamic civilisation. It is showed, in particular, that contrary to the notion that the technology of printing somehow bypassed Muslims, the Islamic civilisation have left substantial evidence that block printing was a craft familiar to many in the medieval Islamic world between the 10th and the 15th centuries, long before Gutenberg invented press printing. The most common texts to have survived are amulets, of which several dozens survived, some of which are preserved in European and US libraries and museums.

Saudi Aramco World Magazine

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1. Preface, by *Aramco World* editorial board

By 1980, the Computer Revolution - or Data Processing Revolution - had begun to transform world communications almost as drastically as the invention of movable type and the printing press in 1454, the rotary press in 1844 and the linotype machine in 1886. Indeed, Christopher Evans, in his book *The Mighty Micro*, flatly predicted that in the 1980's the printed word will slowly but steadily "slide into oblivion".

Dr. Evans, to be sure, based his predictions on devices still in the experimental stage: computer terminals the size of a book's page, automatic "page turning" and ceiling screens for comfortable reading in bed. But he also notes that practical "electronic newspapers" are already in existence - such as England's Prestel, that in 1980 began to provide up-to-the-second news, airline schedules and magazine articles for TV screens. And there is no denying that the introduction of computerized typesetting in the 1970's virtually eliminated the typewriter and the linotype machine from most American newspapers and publishing houses.

To some in the publishing and printing industries, such changes were as shattering an experience as the introduction of printing must have been to the medieval scribe. Suddenly forced to swap

their battered typewriters and clanking linotype machines for the futuristic keyboarding and green-lettered television terminals of the computer, aging reporters, veteran editors and trained printers often quailed and quit. As so often happens, the casualties of progress were high.

But the trend is irreversible. Fast, silent and efficient, the computer saves time, reduces noise, cuts costs - and promises a transformation in communications as significant as the effects of the two seminal inventions in the history of communications: paper and printing. Both paper and printing -which changed the worlds into which they were introduced - originated in the Far East, and paper at least was transmitted to Europe through the Islamic world. Like the invention of the alphabet itself, also of Eastern origin, the ramifications of both inventions were far reaching.

In today's print-saturated world, Gutenberg's invention of movable type may not seem as remarkable as it actually was. But given the technology of 1454, making typefaces was proportionately more difficult than making transistors – as J. Ben Lieberman makes clear in *Type and Typefaces*. Craftsmen had to cut out a mirror image of the shape of each letter on the end of a steel rod, hammer the outline of the steel "letter" into a flat piece of brass -to create a matrix - and carefully pour a molten mixture of lead, tin and antimony into the mold, thus creating a one-inch-high piece of "type" with one letter on the end. This had to be done for each letter - and *one* page of Gutenberg's Bible needed up to 5,000 individual pieces of type. The new printers, therefore, had to have up to 25,000 pieces of type on hand – plus another 25,000 spaces to separate the type - if they wished to keep setting other pages while one was being printed.

A pivotal advance, movable type, together with the printing press, made books – and thus literacy and learning available to the masses, a development that was to have incalculable results. Had Columbus been born earlier, for example, he probably would not have had access to such works as the writings of Ptolemy, which spurred him toward the discovery of the New World. Movable type was introduced just one year after the fall of Constantinople sent Byzantine scholars streaming into Italy-with their precious collections of Greek manuscripts-where the printing press provided a channel for the circulation of Greek learning throughout Europe.

Furthermore, printing from movable type, coming as it did at the peak of the Renaissance, was a key factor in the swift dissemination of advances in scientific, technological and industrial knowledge; it thus contributed to Europe's gradual emergence-first to equality, eventually to dominance – in a world long in the shadow of the Ottoman Empire. Conversely, the absence of printing was an important element in the eventual decline of the Ottomans. Lacking printing, the Ottomans were slower to assimilate and circulate the new learning and thus, to an extent, failed to stay abreast of Renaissance Europe, particularly in technology.

Today, of course, printing is firmly established in the Arab world and Arabic typography is among the most interesting. Indeed printing, once it was established in the Arab East, developed almost as rapidly as it did in the West earlier –and has had similar results. This is the story of how that came about.

2. Arabic and the Art of Printing

The Beginnings

Historians generally credit Napoleon with introducing the printing press to the Arab world when he invaded Egypt in 1798. But though Napoleon did bring printing presses - and Arabic type - to Egypt, the story of Arabic printing is, in a sense, even older than printing. It begins in 1311, when the Papacy established chairs for the study of Arabic and other oriental languages at three European universities and at Rome.

This move - to encourage Arabic studies - was the result of a number of factors: Papal correspondence with the Mongol court [1], close ties with the Crusader states in the Levant, long-standing trade relations between the Italian maritime republics and the eastern Mediterranean and-the Papacy's prime interest-a desire to propagate the Catholic faith among the Arabic-speaking Christian communities of Syria, Lebanon and Palestine.

There were other, less political, considerations, too. Translations from Arabic - the language in which Greek philosophy and science had been preserved - were essential to St. Thomas Aquinas and other Christian theologians in their formulations of medieval theology and philosophy; to properly understand Aristotle, the foundation for much medieval thinking, theologians had to read translations of the great commentaries upon him composed in Arabic by such Muslim scholars as Avicenna and Averroes. But most were unsatisfactory.

It is therefore not surprising that it was in Italy, the European country with the broadest interest in the Arabic-speaking world, that the first Arabic book was printed from movable type, in 1514.

Arabic type had been used sporadically before 1514, but no entire book printed in Arabic was produced until Gregorio de Gregorii, a Venetian, published a Book of Hours entitled *Kitab Salat al-Sawa'i*, probably for export to the Christian communities of Syria.

The book was not a great success. Though the borders, depicting arabesque flowers and birds, are charming, the type is crude: squarish, ill-formed letters that are unpleasant and virtually unreadable. It was, nevertheless, a bold attempt, as well as the first, to solve the problems of printing in the Arabic alphabet: designing and making - by hand - hundreds of characters and the connections between characters needed to duplicate the cursive nature of Arabic script. De Gregorii s typeface, moreover, was more successful than the Arabic type used by William Postel in his *Unguarum duodecim*, printed in Paris in 1538 or the eccentric face used in Rutgher Spey's *Epistola ad Galatas*, done in Heidelberg in 1583.

The man who did begin to solve the problems of Arabic printing was the French type designer Robert Granjon, whose name is still associated with a wide range of unsurpassed Latin and Greek typefaces - and the story of how he came to design Arabic type begins with the attempts by the Papacy to unite the Christian churches of the Levant with Rome. As these Christian minorities - Maronites, Greek Orthodox, Jacobite, Nestorian and Coptic - were strongly represented in the important trading centers of the Levant, Constantinople, Aleppo, and Alexandria, Pope Gregory XIII, in 1576, determined to make this connection spiritual as well as commercial. As a start he focused on the Maronites, who had particularly close commercial links with Italy. In 1584, he founded a Maronite College in Rome to train European missionaries in various oriental languages, and to train oriental Christians in the

languages of Europe. Responding enthusiastically, the Maronites threw themselves into the task of editing, writing, and translating books into and from Latin, Arabic and Syriac. But as it soon became obvious that the time had come to seriously undertake the printing of Arabic and other oriental languages, Gregory appointed Cardinal Ferdinando de Medici director of what came to be called the Medici Press. Cardinal de Medici, in turn, sought someone versed in oriental languages to oversee the operation of the press, and was lucky enough to find Giovan Battista Raimondi.

Giovan Battista Raimondi was the archetype of the Renaissance man: an accomplished classicist, a philosopher, a mathematician and a chemist. More to the point, he was also well qualified with regard to Arabic printing. During a trip to the East, he had learned Arabic, Turkish and Persian and collected grammars and dictionaries of those languages. He had also translated books from both Greek and Arabic, and written learned commentaries on Greek scientific works.

To set up an Arabic press, Raimondi rented some buildings on the piazza del Monte d'Oro in Rome, ordered presses, ink, paper and other necessary stocks and through a printer named Domenico Basa, obtained punches with which to cut an Arabic alphabet - punches designed by Granjon. Basa sold the punches to Raimondi and signed an agreement under which they would work together and share materials.

The first books printed under this arrangement - and bearing Domenico Basa's imprint - were the *Liber VII precationum* (1584), a book of Christian Arabic prayers, and the *Hortus rerum mirabilium* (1584), an historical-work by Abu al-Abbas Ahmad ibn Khalil al-Salihi, the full Arabic title of which is *The Book of the*

Garden of the Wonders of the World. This combination of Christian liturgical and Muslim scientific texts was also to be characteristic of the productions of the Medici Press.

Meanwhile, Raimondi had quickly realized that the success of the Medici Press would depend largely on the skill of Robert Granjon and to induce him to stay in Rome, offered a rent-free house, a stipend of 10 gold scudi a month, plus one gold *scudo* for every steel matrix he cut and a bonus of 300 *scudi romani* for every completed alphabet. Although he was 72 years old, Granjon accepted these excellent terms and set to work immediately.

In a few years Granjon had cut a large number of oriental characters, following superb calligraphic designs provided by Raimondi. On September 6, 1586, he completed the small Arabic typeface used for the text of the folio of Avicenna of 1593 (see fig. 1). Legible and much more "oriental" in feel than those of de Gregorii, Postel or Spey, this face was not improved upon until the time of Ibrahim Muteferrika in the early 18th century.

Granjon, who died in 1589, was succeeded by Giovanni Cavaglion, who cut the medium and large Arabic alphabets used in the 1593 Avicenna chapter headings, as well as a small and a large Persian typeface, and a very beautiful Coptic alphabet.

Cardinal Ferdinando de Medici, in the meantime, formed a committee to direct the press and sent two specialists to Ethiopia and the Levant with orders to obtain Arabic, Syriac, Coptic and Ethiopic manuscripts of the scriptures. The manuscripts were to be used to establish critical texts of the Bible.

الكتاب الاول

بسم الله الرحمن الرحيم

الفن الاول من الكتاب الاول في حد الطب وموضوعاته من الامور الطبيعية يشتمل على ستة تعاليم

الفصل الاول من التعليم الاول من الفن الاول من الكتاب الاول من كتاب القانون

في حد الطب

Figure 1: *Canon of medicine* by Avicenna (Ibn Sina) published in Rome in 1593 at the Library of the American University of Beirut (© AUB Libraries, 2002-2007).

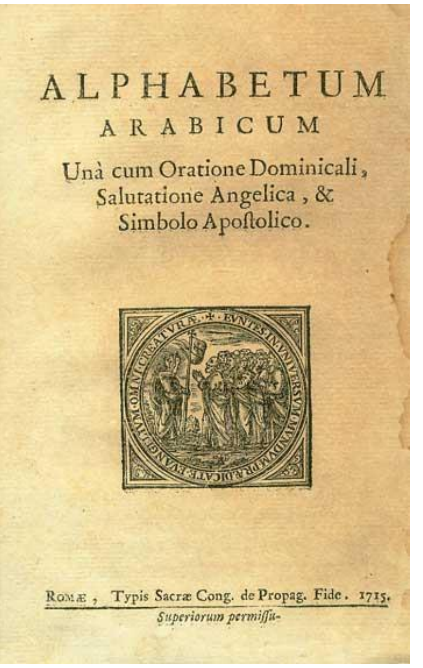
At the same time, the specialists were urged to collect Arabic scientific texts so that they could be printed and then exported to Muslim countries in order to acquaint Muslims with the advantages of printing. In 1587 two Italian merchants actually received a firman - a royal permit-from the Ottoman Sultan Murad III authorizing them to export Arabic books to the Ottoman Empire.

A copy of this firman was printed as the final sheet in the folio Arabic edition of Euclid printed by the Medici Press in 1594. It is the first printed document in Turkish, and is set in Granjon's small Arabic typeface, with some modifications.

Because cutting the Arabic typefaces took such a long time, establishment of the Medici Press went slowly. Though the contracts formally setting up the press were signed on March 6,1584, the first book to bear its imprint did not appear until 1591: it was a folio edition of 4,000 copies of the four Gospels in Arabic, a large edition for the time. The same Arabic text was reprinted, the same year, this time with an interlinear Latin translation by the Maronite scholar Gabriel Sionita, whose many works, including a short history of the Arabs, were among the earliest to be based on a first-hand knowledge of Arabic sources.

Once underway, however, the Medici Press was very productive. In 1592 it issued a prospectus of its Arabic type faces under the title *Alphabetum arabicum* - a 64-page masterpiece of design which not only displays Granjon's beautiful types, but contains a careful Latin Essay on the Arabic writing system (see fig. 2) - two classical works on Arabic grammar, the *Caphiah* (al-Kafiya) and the *Giarrumia*, (al-Ajurrumiya) and the abridged edition of al-Idrisi's famous geography [2], composed, fittingly enough, in Sicily

in the 11th century.



ALPHABETUM
ARABICUM
Unà cum Oratione Dominicali,
Salutatione Angelica, &
Simbolo Apostolico.

ROMÆ, Typis Sacræ Cong. de Propag. Fide. 1715.
Superiorum permissu.

Figure 2: Cover of the *Alphabetum Arabicum una cum Oratione Dominicali, Salutatione Angelica, & Simbolo Apostolico* (Rome, 1715) (Source).

The year 1593 saw the appearance of one of the most famous productions of the Medici Press: the folio edition of Avicenna's famous *Canon of Medicine* (*al-Qanun fi al-Tibb*), a beautiful book employing all three of Granjon's typefaces, the small, medium and large. The book itself had been the standard reference book on medical practice during the Middle Ages, both in Europe and in

the Muslim world, and continued to be so through the Renaissance.

In 1594 the Medici Press published still another important work, the Arabic translation of Euclid with commentary by Nasiral-Din al-Tusi, the famous 13th century mathematician and courtier, thus providing, in the first few years of operation, coverage of medicine, mathematics, geography and grammar, the four subjects particularly cultivated by the Arabs.

Before the press actually published these works, however, the Grand Duke of Tuscany died and Cardinal de Medici, his brother, became the Grand Duke. This was a disaster for the Medici Press because the Cardinal moved to Florence, severed his ties with Raimondi and later, after the Arabic Gospels appeared in 1591, decided to sell the press. Worse, he also decided to sell the books, manuscripts, typefaces and unsold copies of the Medici publications.

Appalled at this, Raimondi bought the press himself, but quickly found he had purchased a white elephant. Books sent to the Frankfurt Book Fair in 1593 - then, as now, Europe's center for the distribution of books - did not do well. And the next year an employee of the press stole a large number of books and sold them cheaply at the fair, thus destroying the market for the remaining copies.

After Raimondi died in 1614, everything that remained of the Medici Press-paper stocks, type, presses, unsold books and the reference library of manuscripts - was transferred to the Villa Medici at the top of the Spanish Steps in Rome. All these materials were later transferred to Pisa, and in 1684 wound up in

the Palazzo Vecchio in Florence. During these moves, some of the type and matrices had found their way to the *Propaganda Fide*, which used them for its oriental publications.

In the 18th century, amazingly enough, many of the books printed by Raimondi were still in the *Palazzo* Vecchio stacked in wardrobes. An inventory taken at the time shows that 1,039 copies of the Arabic-Latin Gospels, 566 of the Arabic Gospels, 810 of the Avicenna, 1,967 of the Euclid, 1,129 of the Idrisi, still remained unsold, along with several other titles. But early in the 19th century - the Age of Enlightenment - the government sold the remaining books for a derisory sum to a bookseller who destroyed the bulk of them to increase the rarity of the remainder. The remaining type and matrices wound up in the Pitti Palace, where Napoleon was able to loot them at his ease when he conquered Italy. In 1808 Napoleon ordered the punches and matrices to be taken to Paris, where they were used to print Arabic proclamations for distribution in the Near East Eightyears later, after Napoleon's exile, they were brought back to Florence.

Meanwhile-in 1610, the year the last Arabic book came off the Medici Press - a book in Arabic was printed in the Middle East itself: the famous *Quzhayya Psalter* -the Bible's book of psalms.

The *Quzhayya* Psalter is a small folio containing 260 pages, each divided into two columns, the right-hand column containing the Syriac text, the left-hand column the Arabic translation printed in a smaller Syriac typeface. At the bottom of the page, in the colophon, are clues to the story of the Psalter. It reads: "Printed in the honored monastery of Wadi Quzhayya, on Mount Lebanon, the work of master Pasquale Eli and of the humble Yusuf ibn Amima from Karm Sadde… 1610."

Pasquale Eli was *an* Italian printer while Yusuf ibn Amima had been a student at the Maronite college in Rome, and was a member of a delegation sent to Rome in 1610. Since his name appears in the colophon, it is probable the delegation brought back a press to print the psalter. This psalter was unique - since no other books followed from the press at Quzhayya - and almost a century was to elapse between the printing of the Quzhayya Psalter and the next book printed in Arabic in the East - this time in the Arabic alphabet.

Strangely enough, this took place in the Ottoman protectorate of Walachia, now in Romania, where the Greek Orthodox Patriarch of Syria, Athanasius Dabbas, set up a press which printed liturgical works in Arabic; they *are*now among the rarest of printed Arabic works. In 1704 Athanasius returned to Aleppo and established a new Arabic press, at which, it is said, Abd Allah Zakhir, an apprentice goldsmith, with the help of his brother, not only set up the press, but engraved all the matrices, made the tools, and cast the type; all without ever having seen a printing press in operation.

In the story of Arabic printing, Abd Allah Zakhir played an interesting role; his first typeface was used in 1706 to print a Psalter and though the letters are crude, two more books were orinted with it. But then he abandoned it and cut two new faces - both more elegant and closer to the naskhi style of Arabic handwriting - which were used in the edition of the Paracletic published in 1711. Between 1706 and 1711, some nine titles were printed by the Aleppan press.

Inexplicably, after the publication in 1711 of a treatise by the Patriarch himself, the press in Aleppo suddenly ceased operating,

but Zakhir later set up another press at Choueir in Lebanon, and once again set about cutting type molds and founding his typeface. The press itself was brought from Europe, and in 1734 he printed his first book; this press continued to be used at the monastery of Saint John at Choueir until 1899.

Like his contemporary Ibrahim Muteferrika, Abd Allah Zakhir had to overcome difficulties which would have proved insurmountable to a lesser man. With no formal training, he mastered a difficult craft without teachers and with few guides. But his true importance is that he was the first man to print books in Arabic with movable type in the Middle East.

The Ottoman Contribution

Five years before 'Abd Allah Zakhir set up his own press, a momentous event occurred in Istanbul, capital of the Ottoman Empire. In January, 1729 - the same year Benjamin Franklin's recently formed printing house received its first government contract - the first book printed in the Arabic alphabet under the auspices of an Islamic government came off the press.

It was momentous because it signaled official recognition of the disturbing decline of Ottoman power-and of the importance of printing in the rise of European power. It also signaled a victory for the man who, more than any other, persuaded the Ottoman Sultan that only wide dissemination of Europe's scientific and technological knowledge could enable the empire to arrest the decline - and founded a press to do so. This was Ibrahim Muteferrika, the Benjamin Franklin of the Muslim world. Born about 1674, Ibrahim Muteferrika was an extraordinary combination of soldier, scholar, diplomat and writer who, as a

child, may have witnessed the long disconsolate retreat of the great Ottoman army from its unsuccessful siege of Vienna-the inescapable sign of the decline in Ottoman military might.

The reasons for the decline were many and complex, but to Ibrahim Muteferrika and other far-sighted men, the solution was not. They believed that unless European military innovations were adopted, the antiquated Ottoman army would be unable to defend the Empire, and that the only route to such reform was rapid and wide dissemination of the scientific ideas which underlay European military power. In short he thought the Ottomans must establish a printing press and translate key European works into Turkish.

These ambitious plans were more easily made than carried out. Aside from the technical problems of obtaining materials, either buying or cutting an Arabic typeface - since Turkish was then written in Arabic script- and learning the craft, there was the problem of the immense conservatism of the Ottoman state. Although Hebrew and Armenian presses had existed in Constantinople for a long time, no one had ever printed with Arabic type. It was perfectly possible that the innovation would be opposed simply on the grounds that no one had done it before.

Fortunately, Ibrahim had two powerful allies. These were Mehmed Chelebi Pasha Yirmisekiz and his son Sa'id, who in 1721, had returned from a diplomatic mission to Paris filled with enthusiasm for various aspects of French culture-among them printing-and had conveyed this enthusiasm to the Sultan and his court. Eventually, therefore, the Grand Vizier, Ibrahim Pasha, encouraged Ibrahim Muteferrika to address a petition to the

Sultan - which Ibrahim did in the form of an essay entitled Wasilat al-Tiba'a, "The Utility of Printing."

"The Utility of Printing" is a remarkable document. It opens with a closely reasoned warning on the importance of preserving a nation's laws-and on the difficulties of doing so.

Ancient peoples, Ibrahim argues, engraved their laws on tablets or wrote them down in books, but throughout history both tablets and books have been destroyed - one reason why Muslims carefully guarded the text of the Koran and the Traditions by making copies and circulating them among the believers, who learned them by heart.

Unhappily, Ibrahim goes *on*, even the power of the state cannot always protect books from the ravages of war. Genghis Khan and Hulagu, the Mongol conquerors of the 12th century, in destroying the empire of the Abbasids, burned or spoiled all the works of art and science which they found - and the Christians captured thousands of irreplaceable books when they conquered Muslim Spain.

These events did irreparable harm to Muslim learning, Ibrahim writes, because while the Christians retained possession of a great number of Arabic works on the useful sciences, the Muslims were deprived of them forever. "All of these considerations should be borne in mind when considering the utility of the establishment of a printing press in Constantinople."

Ibrahim goes on to list his specific aims: Arabic is the language of science; Turkish speakers need good dictionaries to acquire the language; printing can produce such dictionaries, as well as works

on astronomy philosophy, history and geography cheaply and exactly.

With printed books, Ibrahim argues, scholars and students can be sure of the faithfulness of their text to its original, and will be spared the laborious job of collating manuscripts.

Moreover, he goes on, the ink used for manuscripts is effaced by dampness, while printer's ink, which is oil-based, is impervious. As printed books are cheap, both poor and rich can now devote themselves to study without worrying about the costs. Since public libraries in the provinces can be supplied with printed books, learning will thereby be spread throughout the Empire.

Ibrahim also points out that there *are many* Muslims throughout the world who are not Ottoman subjects and printing could supply them with books by which they might instruct themselves.

"The famine of books will be at an end. All nations will be able to acquire books at low cost. What glory for our Empire, and what prayers for its perpetuity will be made, when they see so many good books which communicate knowledge to them, of which till then they had been destitute. This motive alone should suffice for our Invincible Emperor to protect and permit the establishment of printing."

In the course of his enumeration of the advantages of printing, Ibrahim also casts a critical eye on the products of European presses which had printed Arabic books.

"European rulers have recognized the importance of works written in Arabic, Persian and Turkish, and have printed books in

all languages... but... the books are filled with errors and the type is ugly... ."

But, he goes on, this too is an argument for setting up a printing press in Constantinople. "If these European presses should cut type based upon a good oriental hand, the trade in their books will prove detrimental to our interests, for money will flow from us to them.

"It is therefore vital for the Muslims," he concluded, "formerly in advance of the West in the sciences, not to let themselves be eclipsed by them."

When the Sultan Ahmed III received Ibrahim Muteferrika's petition, he submitted it to the Mufti, Shaikh Abd Allah, the leading authority on Islamic law, with this question; "A certain man has cast metal letters in order to print the classical works of literature and science, such as dictionaries, works on logic, philosophy, astronomy, and so on, and has offered to undertake to print them. Can he, in accordance with the rules of justice, execute his design?"

Shaikh 'Abd Allah's response-very like a Supreme Court decision - was yes, he could: "If such a one has mastered the art of printing the aforesaid works correctly with metal characters, providing a sure means of saving work and of making multiple copies at low cost, thus making their acquisition easy and less costly, then I rule that this art, because of its great advantages, must be encouraged. In order to avoid misprints, able and intelligent men must be chosen, who, before the books issue from the press, shall correct them, by comparing them with the best available manuscript texts."

Far from opposing the innovation, then, the religious authorities welcomed it. But as they naturally stipulated that every effort should be made to avoid misprints, the government appointed four eminent qadis as proof-readers - the first in Islam to undertake this laborious and thankless task. The authorities also ruled that only secular works might be printed - to protect the more than 4,000 professional copyists of Constantinople, whose work consisted almost entirely in copying the Koran, the collections of canonical traditions, and legal texts.

Shaikh 'Abd Allah's decision was issued in 1726, but it was more than two years before Ibrahim was ready to print; he first had to gather materials, learn how to print and design and cut the type.

Some historians assume that Ibrahim imported his Arabic typeface from Europe, but Ottoman documents unequivocally state that Ibrahim designed and cut his type himself-and it is certainly different from European Arabic typefaces of the same period. It is closer to naskhi, the standard book hand of the Muslim world, very similar to typefaces used in the Middle East today, and, for several reasons, a remarkable achievement.

Printing with the Arabic alphabet involves a number of difficulties which are not found with the Latin alphabet, or even with other Semitic alphabets. One is that each Arabic letter has four different forms, depending upon its position in the word, and another is that Arabic is a cursive script-that is, most letters *are* linked to the preceding and following letter by a ligature, which varies in both length and direction. A third problem is that since calligraphy is the supreme Islamic art [3], readers tend to be critical, even of legible type faces, on esthetic grounds. Today for example, few readers are entirely happy with the computerized type in Arabic

newspapers. Yet Ibrahim, working with no training or technical background, not only produced a legible type face, but one that pleased his readers. When the first book rolled off the presses in 1729, the Mufti who had authorized its printing wrote, "This book must be regarded as a pearl."

The book referred to was a Turkish translation of an Arabic dictionary, in two volumes, the first containing 666 pages, the second 756. Known as the Sahah ("The Correct"), it was composed in the 10th century by al-Jawhari, and is one of the classics of Arabic lexicography. It contains more than 22,000 root words, and each usage is illustrated by quotations from the poets. The second book, a maritime history of the Turks by the great Ottoman writer Hajj Khalifa, was less formidable: only 150 pages long. But like the two volumes of the Sahah, it was issued in an edition of 1,000 copies - a large printing for the time - and contained five illustrations: one showing the two hemispheres, another showing the Mediterranean and the Black Sea, another the islands under Ottoman rule, the fourth a map of the Adriatic and its islands, and the fifth a double mariner's compass, beautifully engraved, with the names of the winds in Turkish, Persian and other languages. These illustrations testify to Ibrahim Muteferrika's skill as a map maker and engraver.

The *Maritime Wars* also contains information on cities, ports, borders, islands and sites of important naval battles; it gives an account of Ottoman naval battles in the Archipelago, the Black Sea, the Red Sea, Arabian Gulf and the Gulf of Venice, lists famous Ottoman admirals, including Piri Reis [4], and describes different methods of navigation.

Another interesting book published by Ibrahim Muteferrika was a history of the discovery of America. Printed towards the beginning of April, 1730, it is the first Islamic printed book with figural illustrations. Based partly on Latin sources, the *History of the West Indies* contains an introduction on the geographical views of ancient writers -showing their ignorance of the New World -and then gives an account of the Spanish discoveries, including fabulous stories of the flora and fauna of the New World, illustrated by 13 prints and four maps, engraved by Ibrahim (fig. 3-5).

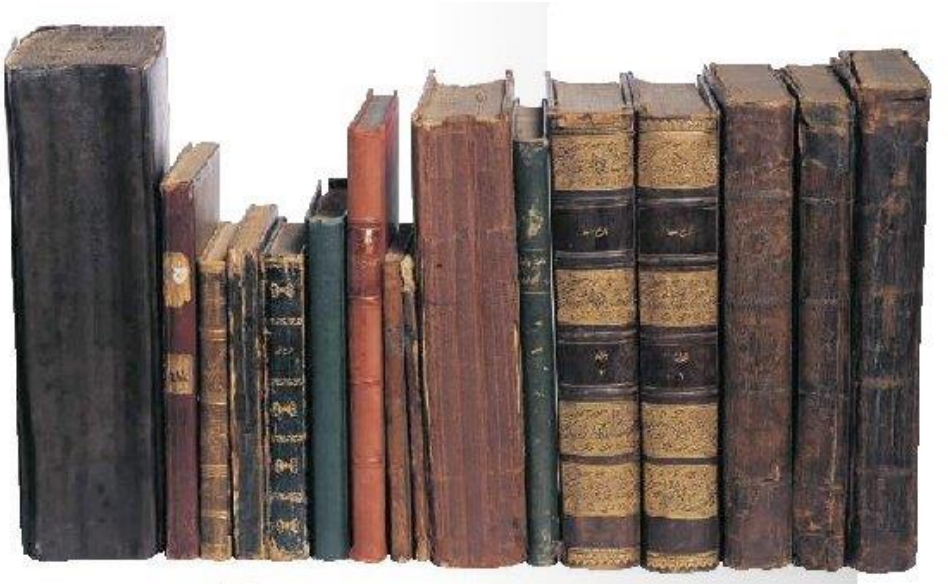


Figure 3: Books printed at the Ibrahim Müteferrika Press.

One of the most important books which came off the press in Constantinople was written by Ibrahim Muteferrika himself, and was devoted to the decline of the Ottoman Empire which had led Ibrahim to found the press in the first place. Called the *Nizam al-Umam* ("Ordering of the Nations"), this book was written to

convince the Sultan and the court to introduce European tactics and organizational methods into the Ottoman army.

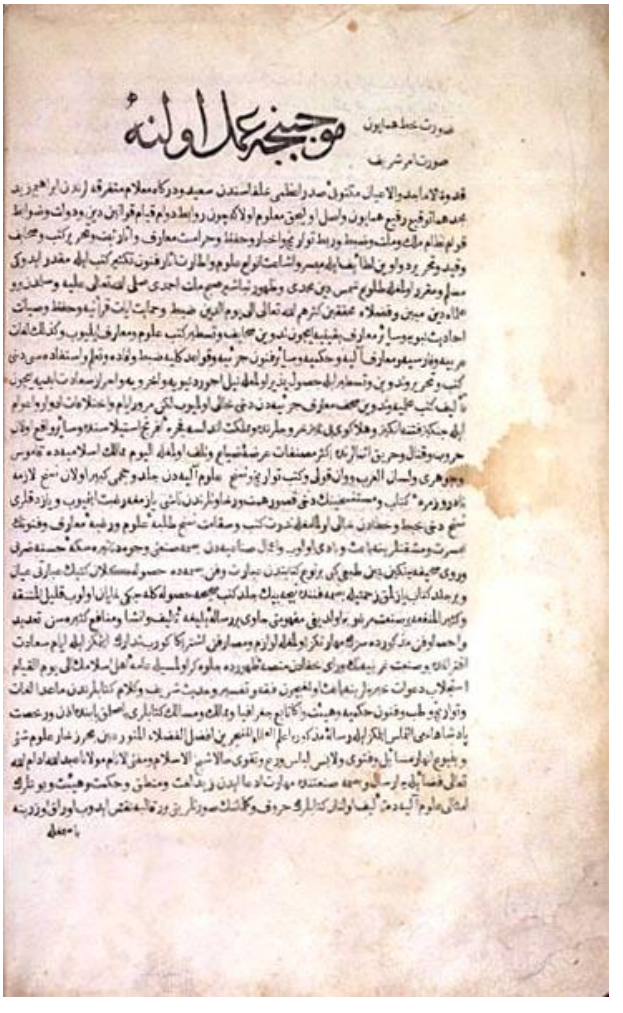


Figure 5: Abu Nasr Ismail al-Jawhari's *Vankulu Lugati* (an Arabic-Turkish dictionary) was published by Ibrahim Muteferrika in 1729; it was the first book printed by Muslims making use of movable type (Source).

This book was both bold and innovative. By stressing the need for order and written legislation in the governing of a nation, and in

discussing political and military geography and European military arts, tactics and weapons, Ibrahim, in effect, was criticizing the Ottoman's proud and powerful military complex. Although the book seems to have had little effect, it marks one of the first stages in the modernization of Turkey.

Ibrahim's press also published the Jihan-Numah, ("Mirror of the World"), by Hajji Khalifa, the same man who wrote "The Maritime Wars of the Turks,"- probably the most beautiful book in its catalog, *as* well as the most ambitious. Published on July 3,1732, it contains 698 pages, and 39 illustrations, among them 24 maps.

It also includes the first discussion in the Islamic world of the ideas of Galileo, Copernicus, and Tycho Brahe. Based on both European and Islamic sources, it gives the latitudes and longitudes of many Asian towns with greater accuracy than any previous work, and for this reason was much esteemed by European cartographers. In the Preface, Ibrahim Muteferrika makes a plea for printing up-to-date maps. "Otherwise", he says, "we will make no progress in the science of geography."

The last book printed by Ibrahim, like the first, was a dictionary, this time Persian-Turkish. It was printed in 1742,13 years after the foundation of the press. Three years later, in 1745, Ibrahim Muteferrika died and the press virtually ceased production until 1783, when, with the help of two old men who had worked with him, printing in Turkey was revived, this time to stay.

Figure 4: Illustrations from *Tarih ül-Hind il-Garbi el-müsemma bi-Hadis-i nev* (Istanbul: Ibrahim Müteferrika Press, 1142 H [1729]), 91 leaves

Napoleon in Egypt

In 1798 Napoleon, fresh from the conquest of Italy, decided to invade Egypt-to gain naval control of the eastern Mediterranean and cut Britain's route to India - and in May the French fleet set sail from the port of Toulon for Alexandria.

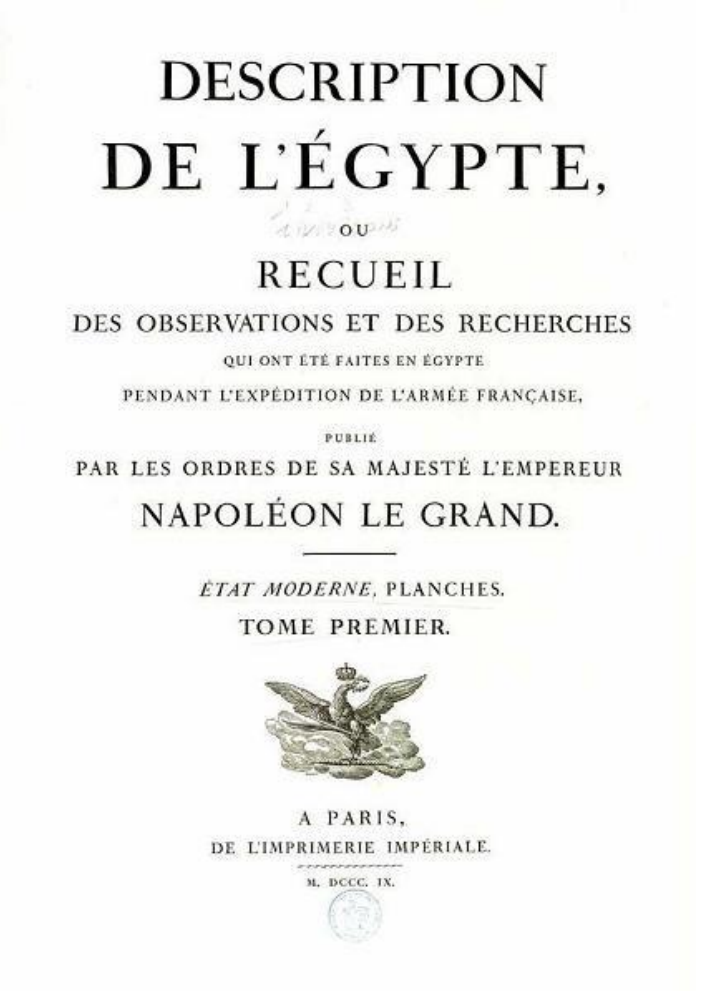
Two months before the departure of the fleet, Napoleon gave orders to pack the Arabic, Greek and French type of the Imprimerie Nationale and ship it to Toulon, and on April 3 also arranged to send the famous press of the *Propaganda Fide* and its oriental typefaces to Egypt. So by one of history's curious coincidences, one of the presses intimately associated with the birth of Arabic printing in Europe was destined to introduce Gutenberg's art to the land of the Pharaohs.

Napoleon took a personal interest in packing and shipping of the presses and the type and in recruiting 34 printers, translators, and typesetters. His correspondence is full of urgent requests relating

to all these matters, and no detail was too small to escape his attention. It may seem odd that the commander of a military operation, beset with thousands of details, should have been so concerned with printing. The answer is that Napoleon was one of the first modern leaders - for better or for worse - to systematically make use of printed propaganda, which he had used for the first time during his Italian campaigns. He planned to use the same methods in Egypt, and quiet the fears of the populace by distributing pamphlets and proclamations assuring the Egyptians that he came not as their conqueror but as their liberator.

He had other, more elevated motives, too. Like Alexander the Great, another famous conqueror of Egypt, Napoleon took with him a large group of *savants*-historians, geographers, engineers, linguists, orientalists, astronomers and physicians-whose mission was to prepare a complete description of the climate, flora and fauna, antiquities, architecture and languages of ancient and modern Egypt. The result was the *Description de I'Egypte* [5]. By doing so, Napoleon perhaps sought to justify his invasion in the eyes of Europe. The reports of the various *savants* were to be printed in Egypt, and perhaps translated into Arabic to acquaint the Egyptians with European science. These plans were only partially fulfilled, for the French stay in Egypt was short, and it was not until long after the armies of Napoleon had left the banks of the Nile that the *Description de I'Egypte*was printed (fig. 6).

Two men were put in charge of the presses. One was the orientalist Jean Joseph Marcel, grandson of a former French Consul in the Levant, and the other was Marc Aurel, an old friend of Napoleon, who met him as a young man in Valence where his father printed a newspaper.



DESCRIPTION
DE L'ÉGYPTE,
OU
RECUEIL
DES OBSERVATIONS ET DES RECHERCHES
QUI ONT ÉTÉ FAITES EN ÉGYPTE
PENDANT L'EXPÉDITION DE L'ARMÉE FRANÇAISE,
PUBLIÉ
PAR LES ORDRES DE SA MAJESTÉ L'EMPEREUR
NAPOLÉON LE GRAND.

ÉTAT MODERNE, PLANCHES.
TOME PREMIER.

A PARIS,
DE L'IMPRIMERIE IMPÉRIALE.
M. DCCC. IX.

Figure 6: Frontispiece of *Description d el'Egypte* (paris, 1809) (Source).

French scholars have sought to determine which of the two men should be credited with introducing printing to Egypt. In fact, the first Arabic printed document of the French expedition was not printed on Egyptian soil at all, but on the high seas - on board the aptly-named *Orient* under the supervision of Marcel, the expedition's official printer.

This first document was a proclamation by Napoleon intended to reassure the inhabitants of Alexandria; it was read aloud to a number of Egyptians who were forcibly taken on board the flagship in the harbor of Alexandria the day before the debarkation of the troops, and the city's capture, on July 1.

Copies were also distributed throughout the city, and on July 7, the day Napoleon left Alexandria for Cairo, he left explicit instructions that the press be set up in the house of the Venetian Consul, who was expelled for the purpose.

Meanwhile, Marc Aurel, the expedition's private printer, accompanied Napoleon to Cairo, and soon began printing the first journal in the Arabic speaking world, the *Courrier de I'Egypte*, a political journal, published every 10 days, in French, for the occupying troops. The first number appeared on August 28, 1798. Later Marc Aurel also began printing the more interesting *La Décade Egyptienne*, a literary journal, until Napoleon, dissatisfied with the number of typographical errors it contained and its poor style, decided to bring the presses in Alexandria to Cairo, and to replace the discredited Marc Aurel with Marcel.

It was not until October that the presses arrived in Cairo. The delay, oddly enough, was caused by the difficulty in hiring enough camels to carry all the cases of type and the presses. Finally, Marcel decided to send everything by boat, and the press was set up in Azbakiyah Square, in the same building which housed the *Institut d'Egypte*, the headquarters of the scientific expedition. But it was still some time before printing could begin. Towards the end of November, we find Napoleon writing once more to Alexandria, asking for "forty cases of type" to be sent on to *Cairo*. Eventually, though, on January 14, the press was ready

and the new *Imprimerie Nationale* began to turn out both the *Courrier* and the *Décade*.

Under Marcel, *La Décade Egyptienne* presented articles on art, architecture, antiquities and medicine, as well as chronicling the cultural life of Egypt during the French occupation. The most interesting articles are those by Marcel himself. He printed his own translations, accompanied by learned notes - which gave him a chance to show off the variety of oriental typefaces he had brought from Rome - of Arabic texts relating to Egypt and other scholarly topics. In 1799 he published a small edition of the fables of Luqman [6] in Arabic, one of the few full-length Arabic books to be printed by the French expedition. Another was a treatise *on* smallpox by a French doctor, which the contemporary Egyptian historian al-Jabarti described as "not bad of its kind."

What impression did printing make on intellectual circles in Egypt? It is commonly assumed that the presses of Napoleon were the first ever heard of *in* Egypt. This is not so. Al-Jabarti's detailed history of the French invasion, of which he was an eyewitness, often mentions the printed announcements distributed by the occupying power, but he evinces little surprise at the process itself. The Coptic communities had been using printed Arabic liturgical works sent from Rome since 1738, and there is little doubt that Ibrahim Muteferrika's pioneer experiment was well known in Egypt.

Still, there was a difference between knowing of a new process and actually seeing it in operation. An article appearing in the *Courrier* for February 13,1801 gives some information of how printing struck educated Egyptians: "Of all the things which have excited the astonishment and admiration of the inhabitants of

Egypt since our arrival in their country, the thing which has made the most impression upon them... was the art of printing. Last year, the principal members of the government, among them the Shaikhs al-Muhdi, al-Fayyumi, al-Sawi and others, came many times to the *Imprimerie Nationale* and there saw with a mixture of pleasure and surprise ... the various processes of printing, both in French and in oriental languages. Shaikh Muhammad al-Fasi, who had already seen printing in Constantinople, and several Syrians who knew the press established in... Kisruwan (Choueir) among the mountains of the Anti-Lebanon, were also astonished at the speed and precision with which the French printers worked... Shaikh al-Bakri, who had not yet seen the *Imprimerie Nationale*, came several days ago to visit the establishment. After having satisfied his curiosity... he asked several questions about the art of printing. Among other things, he asked if France had many printing presses, and whether they existed in other European countries as well, and if so, in which were they most numerous? When his questions had been answered, he asked if printing existed in Russia, and was astonished at the answer that that country had not begun to become civilized until the introduction of printing. He then asked what influence printing had on the civilization of a people, and seemed to understand, and approve of, the answer that was given him, above all: (1) the "ease of multiplying many copies of good books, which in manuscript could only be known to a few and (2) the impossibility that all these copies should be lost or destroyed under any conceivable circumstances - a thing which can easily happen to manuscripts. He then said that there existed a great number of good Arabic books whose publication would be infinitely useful to the country, where most people were unaware of them, and that he sincerely desired that they reach a wider audience through printing. He left

saying that all the sciences came from God, and that if God wished, there was nothing men undertook that they could not succeed in."

Those officials, it turned out, were not the only Egyptians to see the utility of printing. Four years later-after the French forces had left - a young military officer came to power and, realizing the importance of education, began to put printing in Egypt on a firm foundation. His name was Muhammad Ali.

The Bulaq Press

In the history of modern Egypt, few men have contributed more than Muhammad Ali. Ayoung officer when Napoleon came, Muhammad Ali seized power in 1805 - four years after the French left-eliminated the Mamluk aristocracy, asserted his independence of Ottoman rule and, perhaps more important, established the Bulaq Press, a symbol of modernization for the Middle East.

Though poorly educated himself, Muhammad Ali soon saw the need for massive reform if Egypt was to successfully oppose both the might of the Ottoman Empire and aggressive European adventurers like Napoleon. He also realized that the key to the modernization of Egypt lay in education along Western lines, particularly in practical, technical subjects like shipbuilding, engineering, mathematics and medicine, and in 1809 he sent the first of what were to be many missions of Egyptian students to Europe.

Little is known of this first mission except the name of one of the men who was sent-'Uthman Nural-Din, who later became the first director of the Bulaq Press. 'Uthman spent five years in Italy,

mainly in Pisa and Leghorn - both at the time ruled by the Grand Duke of Tuscany-whose ancestors had done so much for Arabic printing in the 16th and 17th centuries - went on to Paris, and returned to Egypt in 1817 with huge orders of books on technical subjects.

Meanwhile, it had become obvious to Muhammad Ali that the system of schools he had established could not function without printed textbooks, and in 1815 he sent Nicolas Musabiki to Rome and Milan to study type-founding and printing. Muhammad Ali also ordered three presses from Milan - along with the necessary paper and ink from Leghorn and Trieste - and, when Musabiki returned, made him manager of the Bulaq Press, working under 'Uthman Nur al-Din. The press itself, in the meantime, had been established in the old Nile port of Bulaq, now a suburb of Cairo, and shortly afterwards, the second, and largest, student mission - it numbered 44 students - had returned from Paris. These men, under the leadership of Rifa'a Bey Rafi' al-Tahtawi, had studied French with a view to the translation of technical books into Arabic. The most prolific of these translators turned out to be al-Tahtawi himself.

Al-Tahtawi had been educated atal-Azhar University, then and now the most prestigious center for the study of the Islamic sciences in the Muslim world. There was apparently no opposition by the Shaikhs of al-Azhar to the innovation of printing; we have already seen how enthusiastic Shaikh al-Bakri had been about the Imprimerie Nationale of Napoleon. Muhammad Ali attached several professors from al-Azhar to the Bulaq Press to learn the art of printing; one became head of the foundry, another printer-in-chief, and others worked as compositors and proofreaders.

Between 1822 and 1842, the press at Bulaq published 243 titles. A glance at these is the quickest way of seeing where the interests of Muhammad Ali and his reformers lay. By far the largest number of books - 48 - were on military and naval subjects. Muhammad Ali had seen both the French and the English fleets in action, and realized how vulnerable Egypt was to invasion from the sea. He had also noted how successful the modern arms of the French had been against the antiquated weapons of the Mamluks.

Interestingly though, the next largest category of books published by the Bulaq Press was poetry. Twenty-six works of poetry in Turkish, Persian and Arabic were published in the first 20 years of the press' operation; clearly the men associated with the Bulaq Press were as interested in traditional Islamic literature as they were in translations of European works on military tactics. After poetry comes grammar, with 21 titles, mathematics and mechanics, with 16, medicine with 15 and veterinary medicine with 12. The rest of the books published by the press were on religion, botany, agriculture, political administration and so forth (see fig. 7-8).

In 1836 Muhammad Ali opened his famous School of Translation in the Azbakiyah quarter, not far from where Napoleon's *Imprimerie Nationale* had been set up. The following year al-Tahtawi was appointed director, and *over* the next 20 years he wrote or translated at least 38 books, on everything from mining technology to the history of ancient Egypt. Many of these were published by the press in Bulaq.

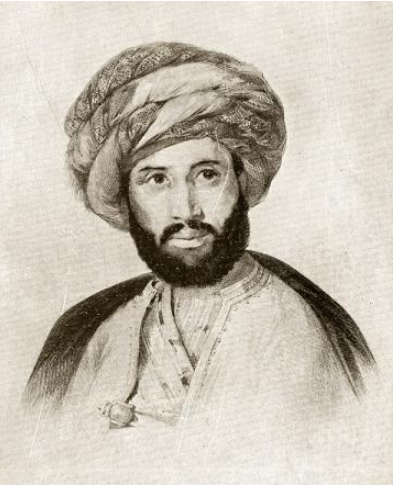


Figure 7: The Egyptian scholar Rafa'a Al Tahtawy who published several books in the 1840s in Bulaq Press

Figure 8: Extract from the journal *El-Waqa'e Al- Masriya* published by Bulaq Press

The School of Translation was faced with almost insurmountable linguisitic problems. The translators had to find Arabic equivalents for western technological terminology, and in many cases their informants - Italians, Frenchmen and Turks - did not speak Arabic. Some books were first translated from French into Italian so that *an* Italian-speaking doctor could help prepare a rough Turkish translation that could then be turned into Arabic and revised by the professors from al-Azhar. Under these conditions, one can only marvel at the productivity of these pioneers of the Arabic linguistic revival.

The only book produced by the Bulaq Press which tells us anything of what the men who took part in the modernization of Egypt under Muhammad Ali thought and felt is al-Tahtawi's engaging account of his stay in Paris. This is much more than a simple travel book; it tells us a great deal, both implicitly and explicitly, about the impact of 19th century European society on a traditionally educated Muslim. Al-Tahtawi was enthusiastic about many aspects of French society, less so about others. He was impressed by printing, education and public works, but found much to criticize, particularly in the sphere of morals. He liked the intellectual ferment of France, and the openess of the people to new ideas: "The Parisians," he says, "*are* distinguished among the Europeans for the subtlety of their intelligence, their vivacity and the depth of their understanding. They love to know things in depth, and *are* only convinced in argument by definite proof. Even ordinary people know how to read and write. They think deeply about things, and every man forms his own ideas. They compose books on all subjects, even the most mundane, such as cooking, which means that even craftsmen must know how to read in order to acquire a complete knowledge of their craft. Every

craftsman seeks to create something never thought of before or to perfect another's invention... The Parisians *are* curious, and have a passion for novelty. They love change in all things, particularly fashion, which changes all the time."

In 1862, the Bulaq Press passed into private hands and by the end of the century its monopoly of printing in Egypt had been broken as a number of privately owned presses were established. Its importance, however, cannot be exaggerated. The Bulaq Press was at once a symbol of modernization in the Middle East and a concrete source of the books - technical translations as well as famous classics of Arabic literature - that spread literacy, speeded development and paved the way for the development of modern Arabic literature.

An American Contribution

While the Bulaq Press was being founded in Egypt, another important Arabic press was set up on the island of Malta by a group of American Protestants, and that press, in turn, spawned what would become the most influential Arabic press after the Bulaq Press: the American Press of Beirut.

The press in Malta was in operation for 20 years - during which it published some 20 titles, both secular and religious, including a book by Abd Allah Zakhir, the first Arabic printer in the Middle East, and involved a man called Faris al-Shidyaq, later a key figure in the renaissance of modern Arabic literature and the first newspaper editor in the Middle East.

In 1833 Eli Smith, the assistant director of the press in Malta went to Beirut and installed a printing press in his home near Bab Ya'qub. This press - the American Press of Beirut -was to become

one of the most productive and important Arabic presses in the Middle East. Under the directorship of Dr. Cornelius van Dyck, who succeeded to the directorship in 1857 the American Press of Beirut probably reached the widest audience of any in the Middle East by publishing writers in the forefront of the Arabic literary revival like Ibrahim al-Yaziji, whose Arabic translation of the Bible won a gold medal at the Paris exposition of 1878. By 1922 the American Press had turned out the unbelievable total of 1,240,000,000 printed pages in Arabic, English, French, Turkish, Armenian, Persian and Kurdish.

The Lithographed Book

The 19th century also witnessed another innovation in printing technology that greatly affected Arabic book production - the introduction of lithography in the 1820's. Because lithography allows the exact duplication of handwriting, it was of particular importance in the Muslim world, which was never very happy about the look of Arabic type. It is no accident that it was in areas of the Muslim world which did not habitually employ the script called naskhi -such as India, North Africa and Iran - that lithography was most popular; it permitted the reproduction of the visual nuances of calligraphy.

Some of the lithographed books produced in the 19th century are very beautiful indeed. They were often written out on the lithographic block by famous calligraphers, and some of them, with their hand-colored title-pages and decorative borders, *are* almost indistinguishable from manuscripts. Lithography was thought particularly suitable for printing the Koran, for many pious Muslims felt that since the Koran was in every sense "scripture" it should be written out by hand.

In India and Iran, where Arabic printing had been introduced in 1814 and 1817 respectively, the lithographed book almost became a traditional craft. Abdul Halim Sharar, the noted Urdu author, has preserved some details of early 19th century lithography in his fascinating book *Lucknow: The Last Phase of an Oriental Culture*: "At first printing was not undertaken on a commercial basis but purely as a private pursuit. The finest quality paper, highly appropriate for lithography, was used and the best calligraphists were employed at high salaries. They were shown great favor without any stipulations as to working conditions or how much they wrote in a day or even whether they wrote anything at all. In the same way the printers were never asked how many pages they had printed in a day. For the ink, thousands of lamps of mustard-oil were lighted to produce fine-quality lampblack. Instead of acid, fine-skinned lemons were used and sponges took the place of cloth. In short, only the finest materials were employed. As a result, Persian and Arabic educational and religious books in the days of the monarchy could not have been printed anywhere else but in Lucknow, where they were produced, irrespective of cost, for discriminating eyes. Books printed at that time represent a fortune to those who possess them. People search for them but cannot find them."

Charmingly illustrated popular romances produced in Iran and India, where lithography practically eclipsed printing after 1824, are collector's items today illustrations 17,19 and 20. A number of very beautiful lithographed books were also produced in North Africa in the late 19th century, particularly in Fez.

Today, of course, printing with movable type, rather than by the lithographic process, has taken over in most of the Middle East, and computerized typesetting is absorbing the energies and

talents of typographers and graphic designers. Yet the new typographers are still grappling with the same problems that faced Granjon, Zakhir, Muteferrika and others: how to marry the beauty of calligraphy to the efficiency of printing, a process that, in the history of the world, ranks with the alphabet-and the computer- in importance and was a vital factor in the modernization of the Muslim world.

3. Facing The Future

Since the invention of printing in the 15th century, artists, technicians and typographers have constantly experimented with new type designs to make the printed page easier and more attractive to read. But typographers in the Arab world, despite similar efforts, have always faced much more difficult problems than those in the West.

Printing in a Western European language, which uses the Latin alphabet, involves approximately 60 letter forms, including small letters, capital letters, commas, apostrophes, dashes and so forth. Printing in Arabic, however, depending on the typeface used, can involve up to 450 forms—more than seven times as many.

It is not that the Arabic alphabet contains many more letters than does the Latin; there are 28 letters in the Arabic alphabet as opposed to 26 in the Latin. But most letters of the Arabic alphabet have four different forms, depending upon their position in the word—that is, whether they come at the beginning, middle, end or stand in isolation. This, of course, is a result of the cursive nature of Arabic script; many of the same problems would result from an attempt to print a European cursive hand. In Arabic, for

example, the letter h, or "ha", may appear in any of the following forms: (see original copy for graphics).

In practice, however, some letters have more than four different forms, depending on the shape of the letter which precedes and follows them. The letter m for example may appear in as many as 73 different guises.

In most cultures, handwriting developed from the printed form of the language. Arabic, however, has been cursive from the beginning; with only a few exceptions the letters forming each word must be joined to each other and there is no such thing as "printing" in Arabic, for the letters cannot stand in isolation. It is the printing of the ligatures which join the letters, attached as they are at different points, that makes printing Arabic so difficult.

Gutenberg, when he set his famous Bible in Mainz more than 500 years ago, only needed one basic piece of type for each letter of the alphabet—not counting, of course, multiple forms of the same letter—while in 1849, when the American Mission Press in Beirut printed an Arabic Bible, no less than 900 characters were used - and even this number was felt to be insufficient. The closer the printer wishes to approximate elegant handwriting, with its variations in the size and height of the letters, the more characters he needs. The great complaint leveled by Ibrahim Muteferrika against the productions of the Medici Press was that the Arabic type was inelegant; he was referring to the restricted number of basic letter forms which gave the page a mechanical look inconsistent with the canons of Arabic calligraphy.

As long as printed texts in Arabic were set by hand, composition was slow and laborious, but still quite practicable. Once the

typesetter had familiarized himself with the physical positions of the multiplicity of characters on his working table, he would pursue his task and eventually produce a frame of type for printing—although in a much longer period of time than his Western counterpart.

The real challenge to Arabic printing came with the introduction of mechanical composition—the linotype machine by which typesetters, at a keyboard similar to that of a typewriter, typed out a full column-width line of type in metal. A Western invention designed to facilitate the printing of texts in Western languages, linotype keyboards were constructed to utilize the number of characters used by Western printers—and were therefore not readily adaptable for printing Arabic script.

Fortunately, however, linotype machines had larger keyboards than those of an ordinary typewriter, as they were designed to accommodate two fonts at the same time: Roman and Italic, or Roman and Bold. This meant that there was room for the integration of about 120 characters within the machine, and a Lebanese immigrant journalist in the United States, Salloum Mkarzel, noticing this, was able, after World War I, to compose his Arabic daily Al-Huda on a linotype newspaper machine utilizing 122 forms.

In the 1950s the late Kamel Mrowa, a publisher in Lebanon, reduced Mkarzel's font to 88 characters and until its demise during the recent civil war in Lebanon, the daily Al-Hayat was regularly printed with it. As a result of such advances, Arabic linotype machines have developed rapidly in the Arab world during the past 20 years.

But as Arabic linotype machines were being introduced in the Arab world, along with monotype setting, type-setting technology in the United States and Europe was changing again. The most significant development was undoubtedly the introduction of a process whereby the text is set photographically; a computer-controlled light, flashing through a filmed letter, registers it directly on a sheet of film, like a lens registering a photograph on film. These new systems are at least 10 times faster than the old linotype process which stamped the letters in metal.

In Arabic printing, computerized typesetting is distinctly superior to the linotype since the computers "matrices" are capable of accommodating as many as 600 letter forms, even though the keyboards have remained essentially the same size as those of traditional composing. More important, filmed type faces and computer science can produce the correct form of a particular Arabic letter, whose design is determined by the letters which precede and follow-freeing the compositor from having to decide himself which form to use. On these new machines, Arabic texts can now be typeset more rapidly and more correctly than ever before.

In spite of such dramatic innovations, there are still problems. Since Arabic printing techniques have until very recently been adaptations of Western technology, little research has been done into the readability of various Arabic type faces.

Though Arabic typography has reflected changes of esthetic taste, a script pleasing to the eye is not necessarily the most readable. In the West considerable research has been undertaken to design fonts that are both elegant and easy to read, but whether these discoveries have relevance for Arabic readers is not yet known,

and more research is needed to ascertain the Arabic reader's response to the variety of type faces with which he is daily confronted. Are the typefaces difficult to read? Do they slow reading speeds? Is there a serious esthetic loss?

From the beginning of Arabic type design by Raimondi and Granjon in 16th century Italy, typographers have unanimously based their type faces on some form of the Arabic calligraphic style called naskhi—and most still do. But as typefaces have developed, they have tended to become heavier and less attractive, and are now a far cry from the elegant naskhi hand of the calligraphers, with its irregular heights, gentle stems, and delicate curves. As a result newspaper headlines are usually the work of calligraphers rather than typesetters, because the ugliness of present-day types tends to be accentuated when enlarged. In many modern newspapers, moreover, a wide variety of calligraphic styles is used in addition to the naskhi form used for most of the text. Arab children learning to read must, therefore, learn to distinguish between a multiplicity of variations in the forms of their alphabet.

The problems—and challenges—of Arabic printing are of serious concern to typographers, printers and educators throughout the Arabic-speaking world.

Recently, serious efforts—including open competitions—have been made to seek new solutions to the problems of Arabic type design. Anyone who is able to design a simplified, elegant standardized type face, which compositors can use quickly and effectively, and readers readily understand, will make a significant contribution to the art of typography.

4. A Missing Link

In the late 19th century, amid a collection of papyrus and paper documents found in the Fayyum oasis in Egypt, a scholar named Karabacek made an astonishing discovery: fragments of block printed Arabic texts. Along with others that have come to light in European and American libraries subsequently these texts should have revolutionized theories about the development of printing. But the discovery has never been publicized and only rarely discussed, outside a small circle of specialists.

The earliest of these texts may date back to the 10th century; some are printed in two colors, and all show a wide variety of calligraphic styles: from an archaic-looking Kufic to an elegant naskhi. One example is printed on a linen envelope while another contains the first six verses of the 34th Sura of the Koran.

But their significance lies in the fact that the fragments are printed; in effect the discovery challenges the long-held Western belief that the Islamic world blocked the transmission of printing from the Far East to Europe. Indeed the Fayyum fragments suggest just the reverse; instead of barring the transmission of printing processes, the Islamic world might have been the means by which those processes did get to Europe.

Printing is traditionally attributed to the invention, by an obscure German named Gutenberg, of a method of printing books with movable type and the publication, in 1454, of the Turkenkalender,a pamphlet warning European leaders of the growing power of the Ottoman Empire. It was published one year after the armies of Mehmetthe Conqueror breached the walls of

Constantinople and one year before Gutenberg printed his famous Bible.

Actually, the art of printing goes back long before Gutenberg to China, where paper was developed in the second century, and to Japan, where an oil-based ink was first produced in the fifth century. Vital to the art of printing, the development of paper and ink enabled the Empress Shotoku of Japan to produce the first printed work known in history: a million copies of Buddhist prayers, produced on single sheets by the process of block printing between A.D. 764 and 777.

Block printing—the antecedent of movable type, linotype and the word processor—used wooden blocks on which the text to be reproduced was carved in relief, inked and transferred by pressure to a sheet of paper.

It is virtually certain that this process was known to the Chinese even earlier. In any case, the Chinese can claim the first known printed book in history: an edition of the Buddhist work, The Diamond Sutra. Dated May 11, 868, this book, like the prayers of the Empress Shotoku, was block printed, a method so successful for printing Chinese characters that in 932 a Chinese government official, Fong Tao, sponsored a block printed edition of 300 of the classics of Chinese literature. The Chinese, furthermore, having seen the advantages of wood block printing, began to experiment with still other methods of book production, and in the 11th century a man named Pi Sheng invented movable type—400 years before Gutenberg. Pi Sheng's characters were made of clay and set in a matrix which could be melted so that the type could be re-used. By the middle of the 13th century, printing with movable type was also being done in Korea, and in 1313 the Korean ruler

Wang Chen ordered a type font containing 60,000 characters, each a single character in wood. The earliest extant book printed with movable type is Korean and bears the date 1361. These breakthroughs, however, were not the direct antecedents of Gutenberg's invention.

In fact, block printing, the precursor of both the Chinese and the German systems of movable type, entered Europe only shortly before the time of Gutenberg. To historians, this has always posed a problem. Why didn't the Islamic world transmit the technique of block printing to the West? Though a political barrier between the Far East and Europe, Islam, after all, had preserved and transmitted the mathematics, the science and the philosophy of the ancient Greeks to the West, as well as the process of making paper. Why then did Islam not transmit such an eminently useful technique as block printing?

One theory was that because the reproduction of images was forbidden in Islam, printing was never adopted in Muslim lands, and was therefore not passed on to the West. But this theory ignores several points. Muslims, for example, accepted the use of seals which are based on the same principle as block printing, and, like the Chinese, stamped their seals of ownership on letters, documents and on the first and last pages of their books. The Prophet himself had a seal ring which bore the legend "Muhammad, Messenger of God." The same argument applies to the process of coining. A punch or die is used to reproduce identical copies of a design, often incorporating a religious text, and Muslim rulers since early Umayyad times had issued coinage. Why then, since the principles are the same, would the Muslims accept seals and coinage, but reject block printing?

Furthermore, there is no prohibition against images in the Koran, and though some Muslims opposed figural art in some places at certain periods, they generally objected only to 3-dimensional sculpture. Muslims of the early 14th century were perfectly acquainted with Chinese printing, as the famous historian and statesman Rashid al-Din, vizier to Ghazan Khan, the Mongol ruler of Iran, made clear in the first volume of his world history in 1307 [7]. The Chinese, he said,

...make copies of books in such a way that no alterations can creep into the text. When they want any book containing important material to be well written and correct, authentic and unaltered, they order a skillful calligrapher to copy a page of that book on a tablet in a fair hand. Skilled engravers are then ordered to cut out the letters. When they have thus taken a copy of all the pages of the book, numbering all the blocks consecutively they place them in sealed bags, like the dies in a mint, and entrust them to reliable persons keeping them securely in offices specially devoted to this. When anyone wants a copy of this book he goes before a committee and pays the dues and charges fixed by the government. They then bring out the tablets, stamp them on sheets of paper like the dies used in coining gold, and deliver the sheets to him...

In his history, Rashid al-Din also gave an example of printing in Iran itself. In 1294, Ghaikhatu, the Mongol ruler of Iran, issued block printed paper money, bearing inscriptions in both Arabic and Mongolian. As it turned out, issuing paper money proved disastrous: the merchants distrusted it, the army refused to accept it and riots broke out. Nevertheless, the experiment shows that wood block printing was known in the Muslim world in the late 13th century-almost a century before it reached Europe.

Finally, there is the discovery of block printed texts in the Fayyum oasis—which suggests that the Muslim world was able to make block prints as early as the 10th century—not very long after the first known block printed books from China.

The importance of this discovery—though overlooked until now—should not be minimized. Quite simply, it destroys the long held Western theory that the Islamic prohibition against images prevented Muslims from either adopting block printing or transmitting it to Europe—as they did other discoveries such as paper.

To the contrary, the Muslims may have provided the route by which block printing did get to Europe. There is an old story about an Italian brother and sister who produced a block printed edition of the Romance of Alexander the Great in Italy in the 13th century, following a process imported from Egypt; in the light of the Fayyum discovery, it deserves to be re-examined.

The Fayyum texts, it is true, contain no complete books. What survive are single sheets of paper, parchment and, in one case, linen. But the earliest of them may date to the early 10th century-just about the time Fong Tao was producing his edition of the Chinese classics—and the latest dates back to 1350, a few years before the first European block print. The fragments, moreover, are attractively designed and laid out, and make use of two-color printing, red and black. The scripts cover the whole range of Arabic calligraphy, from an archaic Kufic to an elegant naskhi-suggesting that Arabic printing in Egypt was the product of long evolution and must have employed a number of craftsmen.

Admittedly, the inference to be drawn from these finds is hard to accept: that the history of printing has been substantially wrong for centuries. Arabic literature, after all, contains no references to Arab printing. On the other hand, the block prints from Egypt provide irrefutable evidence that the Islamic world possessed the technique of block printing before Europe. These block prints are, in effect, the missing link in the evolution of printing.

5. On Paper

Caroline Stone

Without paper, or something like it, and without ink, printing would be virtually impossible and certainly impractical. Indeed, light, cheap materials to which ink could easily be applied, and an ink that could be applied, were as important in the history of printing as were movable type and the printing press.

In a sense, ink goes back to the prehistoric men who first painted on the walls of their caves with ochre, and to their descendants who used dyes from plants and sepia substances from squid, cuttlefish and octopi. But real ink was not developed until the Chinese and the Egyptians, having developed forms of writing, began to search for a substance with which to write and at some point discovered soot.

Until then, soot was just a nuisance. But scraped off cooking vessels and mixed with glue or gum—such as gum arabic—it produced dry molded sticks which scribes then mixed with water to create what is called carbon ink, India ink or Chinese ink.

Carbon ink, probably the earliest writing ink developed, is still used today, but over the centuries man also developed

substitutes. During the Middle Ages, for example, ink in Europe was made with soluble iron salt. It was easier to prepare and could not be erased, but, since it contained sulfuric acid, ultimately destroyed the material on which it was applied.

Another ink was called enkauston—which was used by Byzantine emperors to sign their names and from which comes our word "ink." Various colored juices, extracts and suspensions of substances from plants, animals and minerals have also been used for inks including indigo, alizarin, pokeberries, cochineal and sepia. There is even a recipe for gold ink in a fourth century papyrus now in Leiden in The Netherlands.

With the advent of printing, it became clear that an oil-based ink was vital and the Germans, by mixing varnish or boiled linseed oil with carbon lampblack, developed such an ink. It was so successful that for more than 300 years it continued in use with little modification. Later, varnishes of varying stiffness were developed for different papers and presses, but it was not until the 20th century that ink-making became a complicated chemical-industrial process.

Paper is perhaps more important than ink, but its origins are less ancient. About the third millennium, the ancient Egyptians went down to the banks of the Nile and discovered an uncommon use fora common wild reed growing there. The reed, of course, was papyrus and what the Egyptians discovered was that they could cut papyrus, extract its pith, and dampen and press it into sheets or long rolls. It was the first "paper."

The word "paper," in fact, is derived from "papyrus"—while the Greek word khartes, which denotes the papyrus leaf, became, in

Latin, charta, meaning parchment, from which comes the modern English words "chart," "card," "charter" and the Arabic word for both parchment and paper-qirtas.

The first real paper, however, as distinguished from papyrus, was invented by the Chinese, about A.D. 105. It was made from tree bark, hemp rags and, one fifth-century history of the Han Dynasty claims, fish nets. The use of the new discovery spread quickly through China. Within 30 years of its announcement to the Chinese Emperor—in A. D. 105—a Chinese could write: "I send you the works of the philosopher Hsu in 10 scrolls—unable to afford a copy in silk, I am obliged to send you one on paper."

Paper gradually moved west from China as new techniques increased production—and opened the way for different and finer varieties. By the fifth and sixth centuries, the manufacture of paper had spread into central Asia—a region which was then within the Chinese sphere of influence—and by the seventh century paper was being produced at Samarkand. Then, after the death of the Prophet Muhammad in the year 632, the nascent Islamic empire spread toward central Asia, where, after the defeat of a Chinese military force by the Talas River in 751, the secret of making paper was discovered by the Muslims. The 11th century Arab writer, al-Tha'alabi, says that paper was brought to Samarkand by Chinese prisoners, some of whom were paper makers. The prisoners, al-Tha'alabi wrote, began the manufacture of the new writing material in Samarkand and "thus it (paper) came to minister to the needs and well-being of all mankind. . . "

Arab chroniclers say that the paper introduced into Samarkand was made from "grasses and plants"—possibly because, although the Chinese could make rag paper, raw materials such as paper

mulberry, laurel, bamboo and Chinese grass were cheaper and more plentiful. The Arabs, on the other hand, ultimately favored rag paper made from hemp and linen—probably because the raw materials used by the Chinese were not readily available far from China.

It is uncertain where the Arabs themselves first made paper. One Arab historian says that the first Arab to use it for writing was the Caliph 'Umar at Mecca, and traditionally the Barmakid family, some of whom were viziers and scribes under the eighth century Abbasid caliphs, get credit for introducing the use of paper to Baghdad. But historians also know that Damascus was a major production center, and factories there produced much of the paper bought by Europe until the 13th or 14th centuries.

One thing, though, is indisputable: the use of paper spread quickly through the Islamic world. The new and vibrant civilization stimulated learning—and the growth of governmental bureaucracy—and the demand for cheap, abundant writing materials grew accordingly. Paper met those demands and by A.D. 1000, papyrus production had almost ceased.

Paper, however, was not immediately accepted for all uses. For a long time, copies of the Koran and other religious works were copied on vellum or parchment—partly for reasons of tradition and partly because these products were more durable. And in North Africa, parchment continued to be the medium for ordinary letters until the middle of the 11th century.

As for the rag paper produced by the Arabs, a doctor, originally from Baghdad, wrote rather disapprovingly about one source of rags in the 12th century: "The Bedouin and fellah search the

ancient cities of the dead (in Egypt) to recover the cloth bands in which the mummies are bound, and when these cannot be used for clothes, they sell them to the factories which make of them paper destined for the food markets." Surprisingly, cotton does not seem to have been used in the manufacture of paper until after the industry had reached Europe, although cotton was an important article of trade in the Middle East long before Europe had its own paper industry.

During the 11th and 12th centuries, Syria was the major Arab paper producing region. Factories turned out paper products in Tripoli, Tyre, Tiberias, Hama and, of course, Damascus. An 11th century Persian traveler wrote of Tripoli: "They make good paper here, like that of Samarkand, but of finer quality." From Syria, paper making spread to Egypt—where the nascent industry may well have supported those people put out of work by the declining papyrus industry—and from Egypt paper manufacturing spread across North Africa to Morocco, where Fez became the main center of production.

One anecdote, from theyear 1145, shows how abundant paper was in Fez. When Abd al-Mu'min of the Almohads—a strict, reformist Islamic sect—took the city, the residents feared that the conquerors would destroy the lovely carved arabesques, adorned with gold and paint, which decorated one of the mosques. So they covered the entire interior with sheets of white paper until the walls appeared perfectly plain and attracted no undue attention. The ruse was successful.

From North Africa, paper making ultimately reached Spain and by 1150 al-Idrisi could write of the city of Xativa: "Paper is found there such as cannot be found anywhere in the civilized world,

and is sent to the East and the West." This was the beginning of the export of paper to the Middle East, where Spanish paper was particularly prized for copying books because of its fine quality and durability. But the first paper document from Christian Europe is Sicilian, probably because Sicily was for several centuries under Muslim domination and had continuing contacts with the Arab world (see *Aramco World*, November-December 1970). This document is a deed of King Roger, dated 1109 and written in Arabic and Latin. The first manuscript on paper dates from 1154 and is still preserved in the archives at Genoa.

In Europe there was an initial resistance to the use of paper. The Emperor Frederick II, for example, forbade its use for public documents in 1221. But paper caught on anyway, and in 1157 a paper factory was established at Vidalon on the French side of the Pyrenees. Significantly, its founder, Jean Montgolfier, had learned how to make paper while he was a prisoner of the Muslims in Damascus. In Italy, the first paper factory did not come on stream until more than a century later: in 1276. But it was not until the 14th century that Italy outstripped Syria and North Africa as Europe's main source of supply for paper.

During the Middle Ages paper making became one of the few large-scale industries as consumption soared and it became uneconomical to produce it in small workshops. A letter written from Lebanon in the 11th century, for example, mentions 28 camel loads—about 14,000 pounds—of Damascus paper being sent to Egypt as a single order. Historians say that of the 600 mills turning out various goods in Fez in the 13th century, 400 of them were processing paper.

The primary use of paper, of course, was as a material on which to write, but as early as the ninth century, Arab merchants in China had seen paper towels and even toilet paper—and in medieval times it was also used for packaging. Given the relatively primitive means of transporting goods in medieval times, this was important. Traders used paper, for example, to protect delicate goods, such as silk and coral necklaces, and in the 10th century Iraqi confectionery dealers wrapped sweets in paper. An 11th century writer also mentions citrus fruit-probably oranges—wrapped in paper, and a Persian traveler in Cairo, about the same time, wrote: "In the bazaar the grocers, the pharmacies and dry-goods stores provide the glass bottles, china jars and paper needed to hold or wrap what they sell. Thus, the buyer does not have to worry about containers for his purchases."

The advent of paper in the Muslim world also coincided with a great expansion in banking techniques. New and complicated financial transactions could not have been carried out without paper.

Another use of paper was initiated in 1294 by the Mongol governor of Khorasan; he tried to introduce paper money in Tabriz, the capital (See *Aramco World* November-December 1980). Government officials produced notes printed in Arabic and Mongolian, set up a network of centers for their distribution and, in an Arabic inscription on the notes, gave the date, warned off forgers and promised that "when these notes are put into circulation, poverty would vanish, provisions would become cheap and rich and poor would be equal."

It was an interesting idea, but it didn't work; two or three days after the notes hit the bazaars, the people of Tabriz were in revolt.

End Notes

[1] See *Aramco World*, January-February 1980.

[2] See *Aramco World*, July-August 1977.

[3] See *Aramco World*, July-August 1977.

[4] See *Aramco World*, January-February 1980.

[5] See *Aramco World* March-April 1976.

[6] See *Aramco World*, March-April 1974.

[7] *Aramco World*, January-February 1981.

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